

Thinness Among Young Japanese Women

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Obesity has become a major health problem worldwide in recent years. Health professionals have made efforts to inform the public about the adverse health outcomes of obesity and have emphasized the importance of being “slim.” However, such health education programs may produce unfavorable outcomes in some populations, such as young women, because their desire for thinness is greater than that of other age groups.^{1,2} Fear of being fat may induce unnecessary attempts to reduce body weight,³ producing thinness that in some cases is associated with nutritional deficiencies, irregular menstruation, and eating disorders.^{4–6} Although the adverse health outcomes of thinness or underweight in industrialized countries are not as clear as those associated with obesity, several studies suggest increased mortality in underweight compared with normal weight subjects, as described in cohort studies involving mainly middle-aged or elderly populations.^{7–11} Previous studies suggest that underweight in women of childbearing age is a risk factor for adverse pregnancy outcomes, such as intrauterine growth-restricted or low-birthweight infants.^{12–14}

Yoshiike et al.¹⁵ reported a declining trend in the average body mass index (BMI) (in kilograms per square meter) of adult women (aged 20–39 years) over 1976 to 1995 on the basis of their analysis of nationwide data from the National Nutrition Survey, Japan (NNS-J). However, in this study, there was insufficient discussion of (1) whether this trend could be related to the population size of the participants’ residence area; (2) whether this trend was starting at younger ages; and (3) whether these changes were caused by an increase in the proportion of extremely thin (BMI < 17 kg/m²) subjects. Therefore, we performed in-depth analyses focusing on women aged 15 to 29 years to describe the changes in anthropometry of Japanese women.

Objectives. We described changes in body mass index (BMI) and the prevalence of thinness among young Japanese women (aged 15–29 years) from 1976 to 2000 by reanalyzing the nationwide data in the National Nutrition Survey, Japan.

Methods. We used height and weight data sets for 30 903 nonpregnant, nonlactating women during the 25-year period. We calculated the mean values of BMI and the prevalence of thinness for 3 age groups (15–19, 20–24, and 25–29 years of age).

Results. Changes in BMI per 10 years were –0.17 kg/m², –0.22 kg/m², and –0.34 kg/m² for each age group, respectively. Extreme thinness (BMI < 17 kg/m²) increased from 2.4% in 1976–1980 to 4.2% in 1996–2000.

Conclusions. Further studies regarding topics such as increased smoking prevalence are needed to identify the underlying causes of increasing thinness. (*Am J Public Health.* 2004;94:1592–1595)

METHODS

We evaluated 30 903 nonpregnant, nonlactating women (aged 15–29 years) for whom information on height and weight was available and who were participants in the NNS-J between 1976 and 2000. The NNS-J is an annual nationwide survey that covers approximately 5000 households in randomly selected census units defined by the Ministry of Health, Labour, and Welfare¹⁶ and provides the largest available nationally representative sample with which to monitor dietary intakes, lifestyle factors, and selected biological indicators of Japanese people including anthropometric measurements.

The subjects were divided into 3 age groups (15–19, 20–24, and 25–29 years of age) and were also divided according to the location of their residence (metropolitan, cities, and small towns), which were defined according to population size. Twelve major cities so designated by government ordinance and 23 Tokyo Metropolitan Wards were defined as *metropolitan*, municipalities with 50 000 to 1 000 000 residents were defined as *cities*, and those with fewer than 50 000 residents were defined as *small towns*. The census units were not always the same every year; therefore, the chance of selecting the same subjects twice was small over the 25-year period.

To evaluate the prevalence of thinness, we defined a BMI of 18.5 kg/m² as the cutoff

for thinness according to the criteria set by the Japan Society for the Study of Obesity.¹⁷ Furthermore, we analyzed the prevalence of extreme thinness using a BMI cutoff of 17 kg/m².

To evaluate the trend in mean height, weight, and BMI, a general linear model was used to obtain the increment of each parameter per 10 years, as previously described by Yoshiike et al.¹⁵ Logistic regression analysis was used to investigate trends in the prevalence of thinness across survey year periods within the same age and residential area group. All statistical analyses were performed with the SPSS statistical package program (SPSS Inc, Chicago, Ill).

RESULTS

The mean height, weight, and BMI values for each survey year period, grouped according to subject age range and residential area, are shown in Table 1. Increases in mean height were significant in all age and residential area groups. Significant increases in weight were observed in only 3 groups: those aged 15 to 19 years in small towns and those aged 25 to 29 years in both cities and small towns. A trend of decreasing mean BMI was significant for all groups of young women, except for subjects in the 15- to 19-year-old group who lived in small towns. The greatest decrease was observed in subjects aged 25 to 29 years in met-

TABLE 1—Changes in Height, Weight, and Body Mass Index Among Young Japanese Women: 1976 to 2000

	1976-1980			1981-1985			1986-1990			1991-1995			1996-2000			Changes per 10 years	95% CI	P
	No.	Mean	SD	No.	Mean	SD	No.	Mean	SD	No.	Mean	SD	No.	Mean	SD			
Height (cm)																		
15-19 y																		
Metropolitan	453	156.3	5.2	434	156.8	5.4	424	157.5	5.1	434	157.5	4.9	294	158.3	5.1	0.93	(0.61, 1.25)	<.01
Cities	1154	156.2	5.0	1168	156.9	4.9	1287	157.5	5.2	1096	157.9	5.0	815	157.6	5.2	0.85	(0.66, 1.05)	<.01
Small towns	1202	155.7	5.1	962	156.8	5.1	768	157.0	5.3	596	157.6	5.4	492	157.6	5.0	1.02	(0.79, 1.25)	<.01
Total	2809	156.0	5.1	2564	156.9	5.1	2479	157.4	5.2	2126	157.8	5.1	1601	157.7	5.1	0.95	(0.81, 1.08)	<.01
20-24 y																		
Metropolitan	438	156.1	5.2	363	157.4	5.4	348	157.8	5.2	396	158.1	4.7	317	158.7	5.3	1.18	(0.85, 1.51)	<.01
Cities	860	155.6	5.2	767	156.9	5.0	848	157.5	5.7	929	157.8	5.2	834	158.0	5.3	1.17	(0.94, 1.39)	<.01
Small towns	819	155.2	5.3	625	156.0	5.3	462	157.4	5.3	443	157.7	5.5	366	157.6	5.7	1.37	(1.09, 1.65)	<.01
Total	2117	155.6	5.2	1755	156.7	5.2	1658	157.5	5.5	1768	157.9	5.2	1517	158.1	5.4	1.27	(1.12, 1.42)	<.01
25-29 y																		
Metropolitan	553	154.9	5.2	351	155.9	5.2	358	157.1	5.1	385	158.0	5.3	363	158.5	5.1	1.83	(1.53, 2.13)	<.01
Cities	1426	154.3	5.0	1034	156.0	5.2	961	157.1	5.1	839	157.3	5.7	869	158.2	5.3	1.86	(1.67, 2.06)	<.01
Small towns	1120	154.2	5.6	785	155.5	5.3	583	156.2	5.3	447	157.2	5.3	435	157.5	5.4	1.75	(1.49, 2.00)	<.01
Total	3099	154.3	5.3	2170	155.8	5.3	1902	156.8	5.2	1671	157.4	5.5	1667	158.1	5.3	1.85	(1.71, 1.99)	<.01
Weight (kg)																		
15-19 y																		
Metropolitan	452	50.6	6.8	434	50.7	6.5	423	50.9	6.2	433	50.6	6.1	293	50.7	6.8	0.12	(-0.29, 0.53)	.57
Cities	1150	51.0	6.3	1168	51.1	6.9	1286	51.4	6.4	1095	51.6	7.0	809	51.0	6.9	0.11	(-0.15, 0.37)	.42
Small towns	1202	51.1	6.5	962	51.8	7.1	768	51.6	6.8	596	52.4	8.6	492	51.9	7.5	0.47	(0.15, 0.79)	<.01
Total	2804	51.0	6.5	2564	51.3	6.9	2477	51.4	6.5	2124	51.6	7.4	1594	51.2	7.1	0.19	(0.01, 0.37)	.04
20-24 y																		
Metropolitan	436	50.2	6.9	363	50.9	6.9	346	50.4	6.6	395	50.7	6.8	316	50.8	7.0	0.24	(-0.20, 0.67)	.28
Cities	856	50.2	6.3	767	50.7	7.2	847	50.2	6.8	927	50.5	6.9	831	50.9	7.6	0.29	(-0.00, 0.59)	.05
Small towns	817	50.7	7.2	625	50.6	7.4	462	51.2	7.6	443	50.8	7.2	366	51.4	7.7	0.38	(-0.01, 0.77)	.05
Total	2109	50.4	6.8	1755	50.7	7.2	1655	50.5	7.0	1765	50.6	7.0	1513	51.0	7.5	0.27	(0.06, 0.48)	.01
25-29 y																		
Metropolitan	552	50.4	7.5	350	50.8	7.1	358	50.6	6.8	385	50.7	7.5	363	50.9	7.0	0.16	(-0.26, 0.58)	.47
Cities	1419	50.5	7.3	1034	51.0	6.9	960	51.2	7.3	838	51.2	8.3	861	51.3	8.4	0.36	(0.08, 0.64)	.01
Small towns	1115	50.9	7.1	784	51.2	7.3	583	51.7	7.6	447	51.6	7.7	432	52.1	9.1	0.64	(0.29, 1.00)	<.01
Total	3086	50.6	7.3	2168	51.0	7.1	1901	51.3	7.3	1670	51.2	8.0	1656	51.4	8.3	0.38	(0.18, 0.57)	<.01
BMI (kg/m²)																		
15-19 y																		
Metropolitan	451	20.69	2.38	434	20.61	2.37	423	20.52	2.29	433	20.41	2.16	293	20.23	2.53	-0.19	(-0.34, -0.04)	.01
Cities	1149	20.91	2.38	1168	20.74	2.54	1286	20.69	2.30	1095	20.68	2.68	809	20.53	2.52	-0.18	(-0.28, -0.09)	<.01
Small towns	1198	21.02	2.31	962	21.07	2.60	768	20.92	2.47	596	21.07	3.16	492	20.87	2.72	-0.07	(-0.19, 0.04)	.22
Total	2798	20.92	2.35	2564	20.84	2.54	2477	20.73	2.35	2124	20.73	2.74	1594	20.58	2.59	-0.17	(-0.23, -0.10)	<.01
20-24 y																		
Metropolitan	436	20.55	2.43	363	20.55	2.48	346	20.24	2.35	395	20.30	2.72	316	20.12	2.47	-0.20	(-0.36, -0.05)	.01
Cities	855	20.70	2.39	767	20.57	2.68	847	20.20	2.42	927	20.25	2.55	831	20.37	2.75	-0.19	(-0.30, -0.08)	<.01
Small towns	817	21.04	2.68	625	20.78	2.67	462	20.67	2.84	443	20.42	2.63	366	20.67	2.77	-0.21	(-0.35, -0.07)	<.01
Total	2108	20.80	2.52	1755	20.64	2.63	1655	20.34	2.54	1765	20.31	2.61	1513	20.39	2.70	-0.22	(-0.30, -0.15)	<.01
25-29 y																		
Metropolitan	552	21.00	2.88	350	20.90	2.77	358	20.52	2.64	385	20.33	2.93	363	20.26	2.55	-0.42	(-0.58, -0.25)	<.01
Cities	1417	21.24	2.93	1034	20.96	2.70	960	20.76	2.85	838	20.68	3.05	861	20.50	3.16	-0.36	(-0.47, -0.25)	<.01
Small towns	1112	21.39	2.77	784	21.14	2.73	583	21.17	2.92	447	20.87	2.82	432	20.99	3.42	-0.21	(-0.35, -0.08)	<.01
Total	3081	21.25	2.86	2168	21.02	2.72	1901	20.84	2.84	1670	20.65	2.97	1656	20.57	3.12	-0.34	(-0.42, -0.27)	<.01

Note. CI = confidence interval. Twelve major cities so designated by government ordinance and 23 Tokyo metropolitan wards were defined as "metropolitan," municipalities with 50 000 to 1 000 000 residents were defined as "cities," and municipalities with fewer than 50 000 residents were defined as "small towns."

TABLE 2—Prevalence Rates (%) of Thinness (BMI < 18.5 kg/m²) Among Young Japanese Women: 1976 to 2000

Age Group	1976–1980	1981–1985	1986–1990	1991–1995	1996–2000	P for Trend
15–19 y						
Metropolitan	16.2**	15.4**	19.1**	17.6	24.6**	.01
Cities	12.1	17.6**	14.9	18.5	18.3	<.01
Small towns	11.3	12.2	13.2	14.8	14.4	.02
Total	12.4	15.2	15.1	17.3	18.3	<.01
20–24 y						
Metropolitan	19.3*	17.6	25.1	22.3	24.7	.02
Cities	16.1	19.0	24.0	23.3	23.7	<.01
Small towns	13.7	15.8	19.9	23.9	19.7	<.01
Total	15.8	17.6	23.1	23.2	22.9	<.01
25–29 y						
Metropolitan	16.1**	15.7	19.3**	25.7**	25.3	<.01
Cities	14.1*	15.1	18.6	21.6*	24.2	<.01
Small towns	11.4	13.3	15.4	15.7	21.5	<.01
Total	13.5	14.5	17.8	21.0	23.7	<.01

P* < .05; *P* < .01: compared with small towns, within the same age group in each survey year period.

ropolitan areas, whose change in BMI was -0.42 kg/m² per 10 years. The decrease in BMI of subjects aged 15 to 19 years and 25 to 29 years was greater in metropolitan areas and cities compared with small towns. No such difference by residential area was observed in the subjects aged 20 to 24 years.

The prevalence of thinness (BMI < 18.5 kg/m²) in each group over the 25-year period is presented in Table 2. A significant increase in the percentage of thin women was observed in all groups. The percentage of thin women in the metropolitan areas was greater in all age groups in the initial survey period

(1976–1980), and this difference persisted until 2000. The difference between the metropolitan areas and the other 2 areas was obvious in the youngest age group (15–19 years of age); however, the prevalence of thinness among subjects aged 20 to 24 years and 25 to 29 years was similar in metropolitan areas and cities in the most recent survey period (1996–2000). Approximately one fourth of young women surveyed in 1996–2000 were thin in the age groups 20 to 24 and 25 to 29 years.

Table 3 shows the changes in the prevalence of extreme thinness (BMI < 17 kg/m²). There were significant increases in all age groups. Among the subjects aged 15 to 19 years, there were no significant increases when women were grouped according to their residential area. The prevalence of extreme thinness significantly increased among subjects aged 20 to 24 years living in all 3 residential area groups. In the group aged 25 to 29 years, the increases in extreme thinness were significant in women living in cities and small towns but not in those living in metropolitan areas.

DISCUSSION

Our results clearly demonstrate a decrease in the average BMI of young women nationwide (Table 1). The decrease was prominent among women aged 20 to 30 years old. The prevalence of thin women (BMI < 18.5 kg/m²) and extremely thin women (BMI < 17 kg/m²) significantly increased over the 25-year period. There were no differences in BMI changes and prevalence of thinness between the 3 residential areas, with the exception of the youngest age group (Table 1). The decline in BMI or increase in prevalence of thinness was observed in all age groups. The increased prevalence in extremely thin women was not the sole reason for the decline in overall BMI values (Tables 2 and 3).

There may be several reasons for the dramatic increase in thinness or the decline in BMI values among Japanese women of child-bearing age. First, the women who were surveyed had a misconception regarding self-body image as evidenced by the data shown by the 1998 NNS-J,¹⁶ in which over 40% of young women answered that they were overweight despite the fact that the

TABLE 3—Prevalence Rates (%) of Extreme Thinness (BMI < 17 kg/m²) Among Young Japanese Women: 1976 to 2000

Age Group	1976–1980	1981–1985	1986–1990	1991–1995	1996–2000	P for Trend
15–19 y						
Metropolitan	3.3	2.8	3.5	3.0	6.1*	.11
Cities	2.2	3.3	3.2*	2.7	4.3	.05
Small towns	2.2	2.8	1.6	2.9	2.4	.78
Total	2.4	3.0	2.7	2.8	4.1	.01
20–24 y						
Metropolitan	1.1	2.5	3.8	4.6	3.5	.01
Cities	2.9	4.7**	5.3	4.3	5.4	.04
Small towns	2.1	2.1	4.1	3.8	3.6	.03
Total	2.4	3.3	4.7	4.2	4.6	<.01
25–29 y						
Metropolitan	3.1	3.1	3.9	4.9	4.1	.18
Cities	2.5	2.1	4.4*	3.8	4.3	<.01
Small towns	2.2	2.0	2.1	3.6	4.6	<.01
Total	2.5	2.3	3.6	4.0	4.3	<.01

P* < .05; *P* < .01 compared with small towns within the same age group in each survey year period.

mean BMI was between 20 and 21 kg/m².¹⁶ The mean daily energy intake in this population was approximately 1800 kcal/d, with a standard deviation of approximately 600, indicating that over 15% of this population consumed fewer than 1200 kcal/d.¹⁶ Second, the continuous increase in the smoking rate of young women may be the reason for the changes in BMI. Although smoking status is assessed only in subjects aged 20 years or older in the NNS-J, the smoking rate in women aged 20–29 years increased from 11.9% in 1990 to 20.9% in 2000, nearly doubling in those 10 years.¹⁸ Third, it has been suggested that the overall increase in eating disorders among young Japanese women in recent years may be the cause of the decline in BMI values. However, this is unlikely to be the cause. Estimates of the incidence of eating disorders in young Japanese women are 17.1 to 30.7 per 100 000 for anorexia and 5.8 per 100 000 for bulimia,^{19,20} which is strikingly low compared with other industrialized countries, such as the United States (269.9 per 100 000), the United Kingdom (115.4 per 100 000), and Switzerland (70 per 100 000).^{21–23} However, we cannot exclude the possibility that extremely thin women in our study were not affected by eating disorders, because our survey participants were noninstitutionalized individuals.

At 21.6% in the most recent survey period (1996–2000), the high incidence of thinness in young Japanese women presents a striking contrast to that in other industrialized countries. In the United States, for example, the percentage of thin women (BMI < 18.5 kg/m²) of those aged 18 to 24 years was 7.2% in the National Health Interview Survey, 1997–1998.²⁴ Using the same cutoff of BMI value for thinness, the prevalence in young Australian women (aged 18–23 years) was 12%.²⁵

Health problems associated with thinness or underweight have rarely been investigated in industrialized countries. However, recent reports from Australia suggest that underweight women (BMI < 18.5 kg/m²) are more likely to report irregular menstruation or “low iron”²³ and are less likely to use preventive health services such as breast examinations.²⁶ Further studies are needed to identify the presence of health risk behaviors in these thin young Japanese women. ■

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This article was accepted September 3, 2003.

Contributors

H. Takimoto prepared the article and performed the statistical analysis of the data sets. N. Yoshiike had the original idea for the study and prepared the data sets for analysis. F. Kaneda assisted the statistical analysis. K. Yoshita provided technical advice and drafted the article. All authors helped to conceptualize ideas, interpret findings, and review drafts of the article.

Acknowledgments

This study was funded by the Ministry of Health, Labour, and Welfare, Health and Labour Research Grant, Research on Children and Families.

Human Participant Protection

No protocol approval was needed for this study.

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